

Candidate style answers

Critical maths - medium banded responses

Introduction

This resource has been produced by a senior member of the Core Maths examining team to offer teachers an insight into how the assessment objectives are applied. It has taken questions from the sample question paper and used them to illustrate how the questions might be answered and provide some commentary on what factors contribute to overall levels.

As these responses have not been through full moderation, they are banded to give an indication of the level of each response. Please note that this resource is provided for advice and guidance only and does not in any way constitute an indication of grade boundaries or endorsed answers.

The sample assessment material for these answers and commentary can be found on [Teach Cambridge](#).

Question 2

Dev books a holiday which costs £5000.

He pays with his credit card which charges an annual interest rate (APR) of 16%.

Dev wants to pay back the money over **two** years.

He estimates that his monthly repayments will be £208 to the **nearest pound**.

(a) What calculation did Dev do to get £208?

[1]

(b) Is Dev's estimate too low, about right or too high?

Tick (ü) **one** box.

Too low ☐

About right ☐

Too high ☐

Give a reason for your answer.

[2]

Sample answer for question 2

(a) $5000 \div 12 \div 2$

(b) Dev's estimate is 'about right'.

There are 24 months in two years.

Commentary on the answer

(a) This answer is correct.

(b) This explanation is incorrect because the calculation does not take the interest rate into account.

Question 3

An athlete won gold medals in the 100m and 200m races.

- His time for the 100m race was 9.63 seconds.
- His time for the 200m race was 19.32 seconds.

Was his average speed in the 100m race greater than or less than his average speed in the 200m race?

Tick (ü) **one** box.

His average speed in the 100m race was greater than in the 200m race.

☐

His average speed in the 100m race was less than in the 200m race.

☐

Show your reasoning.

[3]

Sample answer for question 3

His average speed in the 100m race was greater than in the 200m race.

Speed = distance ÷ time

Speed = $100 \div 9.63 = 10.38$

Speed = $200 \div 19.32 = 10.35$

Commentary on the answer

This answer has correctly used the formula for working out speed by dividing distance by time. This method is an alternative to doubling the 100m time and comparing to the 200m time. Although the correct tick box has been selected, an explanation of the results calculated has not been included, such as 'so his speed is faster for the 100m'.

Question 4

Here is a statement about the amount of time spent teaching maths in secondary schools in England:

‘On average, secondary schools in England spend only 116 hours per year teaching maths.

International studies show this is far less time than other countries.

Just one extra lesson each week would put England closer to countries like Australia or Singapore who teach 143 and 138 hours of maths per year respectively.’

- (a)** Calculate an estimate of the number of extra maths teachers needed to increase average maths teaching time for years 7 to 11 in England from 116 hours per year up to the time taken in Australia or Singapore.

Use these assumptions:

- there are about 500 000 school students in each year group in England
- a typical secondary school mathematics teacher teaches between 20 and 25 hours a week
- students are at school for 190 days a year.

Show your working.

[6]

- (b)** State clearly any additional assumption(s) you made.

[1]

Sample answer for question 4

- (a)** 116 hours teaching maths

$$500\,000 \times 5 = 2\,500\,000$$

30 pupils in a class

$$2\,500\,000 \div 30 = 83\,333.33$$

25 hours a week = 5 hours a day

$$= 5 \times 190$$

$$= 950 \text{ hours a year}$$

$$\div 5 = 190$$

$$190 - 140 = 50$$

$$50 \times 83\,333.33 = 4\,166\,666 \div 116 = 35\,919 \text{ new teachers}$$

- (b)** No assumption given.

Commentary on the answer

(a) This answer starts off with a correct assumption of class size being 30 and worked from there to how many classes in total are needed for years 7 to 11. This assumption has not been separately stated in part (b) but it would have gained credit for having been stated in part (a). There is also a correct assumption of the teacher working 25 hours and how many hours per year this would be. It is not clear what the purpose of dividing the 950 by 5 is; it appears to be working out how many hours a year the average teacher will spend with each year group. The answer has a correct assumption of the target number of hours being about 140 a year for each class. However, the answer does not correctly address the increase in total teaching hours needed. It subtracts the number of hours targeted per class from the total number of hours per year for each teacher at present, rather than finding the difference between the hours for each class in England at present (116) and the target number of hours (140). There seems to be a realisation towards the end that 116 has not been used so it is brought into the calculation but not correctly. Although some of the working is labelled with what is being worked out, more of this would make the working easier to follow – this is also important for the candidate when working out the solution to an extended problem. Stringing working together with equals signs when the quantities on each side are not equal further confuses the presentation of the solution.

(b) Although no assumptions have been given in part (b), credit would be given for '30 pupils in a class' in part (a).

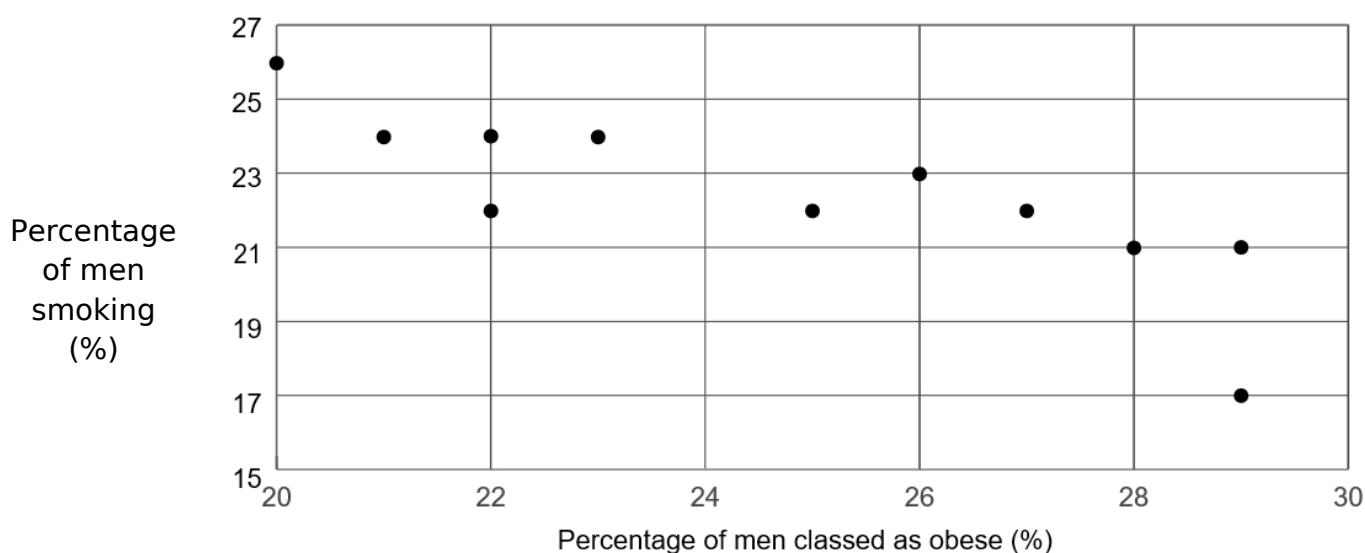
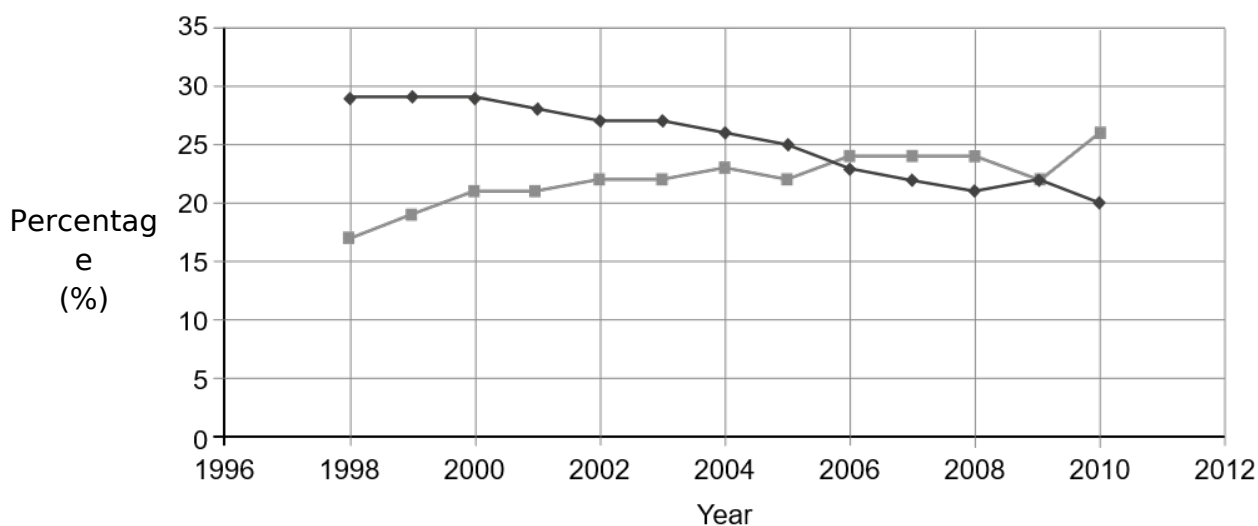
Question 5

The graphs show data about smoking and obesity for men in England from 1998 to 2010.

Key

—◆— Men smoking

—■— Men obese



Make **three** comments about whether the statement below is correct or **not** correct.

‘These graphs show that giving up smoking causes obesity.’

[3]

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Sample answer for question 5

Yes, there is negative correlation. When obesity is the highest then smoking is at the lowest.

When obesity is the lowest, smoking is at the highest.

Commentary on the answer

This answer correctly identifies that there is negative correlation between obesity and smoking. The three comments made however are not distinct, referring only to the correlation. There is no comment on causation – which is what the question was asking.

Question 6

Here are two statements about the same news story.

Statement A: 70% of parents were fined for taking their children out of school for a holiday in term time.

Statement B: The number of parents fined for taking their children out of school for a holiday in term time rose by 70% from the previous year.

(a) Use suitable numbers to show clearly what each of these statements means.

[4]

(b) Explain whether both statements mean the same as each other.

[1]

Sample answer for question 6

(a) Statement A: Of all the parents, 70% of them took their children for a holiday in term time and were fined.

Statement B: Say last year 100 parents got fined, this year 170 parents got fined.

(b) They are not the same thing.

Total = £33.65

Commentary on the answer

(a) For statement A the 70% has not been explained fully using suitable numbers.

(b) This isn't really a comparison between them – merely a statement that they are different without a clear explanation of why they cannot be the same.

Question 7

This question is based on article B in the **pre-release material**, 'Male to female sex ratio'.

A clean copy of the pre-release material is provided as an Insert.

The male to female sex ratio at birth is the number of males that are born for every female born.

The table shows the two countries with the highest male to female sex ratios at birth in 2013.

Country	Male to female sex ratio at birth	Population (thousands)	Births per 1000 of population
Liechtenstein	1.26	37	10.67
Azerbaijan	1.13	9590	17.17

- (a) (i)** Show that the total number of births in 2013 in Liechtenstein can be estimated as 395.

[1]

- (ii)** Show that, of these 395 births, approximately 175 are female and approximately 220 are male.

[3]

- (b)** A researcher is investigating whether the number of males born in some countries is distinctly different from the number of females.

Her initial model is that the long-term probability of a new baby being a male is 0.5.

- (i)** According to the model, what would be the **mean** number of males for 395 births?

[1]

- (ii)** According to the model, what would be the **standard deviation** of the number of males for 395 births?

[2]

- (iii) Explain whether the figures of 175 females and 220 males provide strong evidence that the initial model is **not** correct for Liechtenstein.

[4]

- (iv) In 2013 in Azerbaijan 77 305 females and 87 355 males were born.

Show that these figures provide strong evidence that the initial model is **not** correct.

[4]

Sample answer for question 7

- (a) (i) $37\,000 = 37 \times 10.67 = 394.79$ which is about 395

- (ii) $220 \div 175 = 1.26$ which is the ratio

- (b) (i) $395 \div 2 = 197.5$ females and 197.5 males

- (ii) Standard deviation = $\sqrt{\frac{n}{2}} = \sqrt{\frac{395}{2}} = 14.05$

- (iii) $197.5 + 2 \times 14.05 = 225.6$
 $197.5 - 2 \times 14.05 = 225.6$ so okay

- (iv) 77 305 87 355

$$\text{mean} = 77\,305 + 87\,355 \div 2 = 82\,330$$

$$\text{standard deviation} = \sqrt{82\,330} = 286.93$$

$$82\,330 + 2 \times 286.93 = 82\,904 \text{ and the number of males is higher}$$

Commentary on the answer

(a) (i) This first calculation is correct, but the working contains a string of equals signs between values which are not equal obscuring the structure of the solution.

(a) (ii) The second calculation correctly shows that the ratio of male to female is 1.26 given the number of males and females, but the question asked for these numbers to be worked out from the ratio. This answer has been worked backwards rather than forwards and has not shown that the numbers given are consistent with 395 births.

(b) (i) This calculation correctly works out that if the probability is 0.5 then the expected number of males and females is 197.5.

(b) (ii) There is a mistake in working out the standard deviation – the answer has divided n by 2 then square rooted rather than square root n and then divide by 2

(b) (iii) The answer has used the standard deviation to identify whether the numbers given are outliers. However, the same number has been found by both adding and by

subtracting twice the standard deviation from the mean – there is clearly a mistake somewhere.

(b) (iv) In this part the working for mean is unclear – as written, 87 355 is divided by 2 and then added to 77 305 – this is not a correct method and is not consistent with the answer given so it appears that some brackets have been omitted from the working. As with part (ii), the working for standard deviation is incorrect and the last statement does not address the idea of strong evidence.

Question 8

This question is based on article A in the **pre-release material**, 'Car parking'.
A clean copy of the pre-release material is provided as an Insert.

This sign shows charges for parking in a car park.

Car park charges
Monday to Friday, 9am to 5pm Up to 8 hours - £3
All other times Free
£40 daily fine for parking without displaying a valid parking ticket

Drivers who pay get a ticket to display in their cars.

A warden checks the cars. If they find any cars which are **not** displaying a ticket, their drivers get a £40 fine for that day.

Many drivers use the car park every day from 9 am till 5 pm.

How often, on average, should the warden visit the car park to ensure that drivers who always pay for parking are charged less overall than drivers who never pay for parking?

Assume that:

- some drivers always pay to park and some drivers never pay to park
- all drivers who get a fine will pay it.

Justify your answer using calculations.

[3]

Sample answer for question 8

$3 \times 5 = 15$ so it costs £15 to park for a week.

It costs £30 to park for 2 weeks.

It costs £45 to park for 3 weeks.

So just under 3 weeks.

Commentary on the answer

This answer correctly identifies the need to see how many times 15 goes into 40 to show 3 weeks of parking costs more than the £40 fine. However, it does not answer the question that was asked – how often should the warden visit the car park?

Question 9

Athletes are tested to see if they have used performance enhancing drugs.

Drug tests are **not** completely accurate.

One drug test will show:

- a positive result for 95% of people who have taken performance enhancing drugs
- a negative result for 90% of people who have **not**.

Assume that 5% of athletes use performance enhancing drugs.

(a) Complete the two-way table to show the expected frequencies when a sample of typical athletes is tested.

You need to choose an appropriate size for the sample of athletes that is easy to work with.

	Tests positive	Tests negative	Total
Has taken drug			
Has not taken drug			
Total			

[4]

(b) What percentage of those who are tested will test positive for use of performance enhancing drugs?

[2]

(c) What proportion of those who test positive in this test have actually used performance enhancing drugs?

[2]

Sample answer for question 9

	Tests positive	Tests negative	Total
Has taken drug	475	25	500
Has not taken drug	950	8550	9500
Total	1425	8575	10000

(a)

(b) Percentage $= \frac{475}{10\,000} \times 100 = 4.75\%$

(c) Tested positive $= \frac{475}{10\,000} = \frac{19}{200}$

Commentary on the answer

(a) Starting from a total sample size of 10 000, the representative frequencies are worked out correctly.

(b) The percentage calculated is only taking the positive results from those athletes who use drugs and not adding on those who don't use drugs.

(c) This answer incorrectly finds 475 as a proportion of the original 10 000 people, instead of out of all those who had positive results. The fraction has not been simplified correctly as 475 out of 10 000 is not the same as 19 out of 20; the former fraction is clearly less than a half and the latter is clearly more than a half.

Question 10

There are five competitors in a dancing competition.

Each dancer is judged by six judges who each give a score out of 20.

(a) Design a method to decide which dancers should take first, second and third places.

Give your method as a set of rules that can be used for other similar competitions.

[4]

(b) Explain why your design is fair.

[1]

(c) The table shows the scores for the dancers in a competition.

Dancer	Judge 1	Judge 2	Judge 3	Judge 4	Judge 5	Judge 6
Alex	19	19	15	20	20	14
Emma	12	7	4	4	7	8
Mia	10	8	11	5	5	2
Tom	16	19	20	19	17	16
Yuki	15	6	12	15	6	9

Use the method you designed in **(a)** to work out which dancers come first, second and third.

[5]

Sample answer for question 10

(a) Find the overall points total for each dancer by adding their four best scores out of the possible six. Write the total scores down in order from highest to lowest with first, second and third place being the top three total scores.

(b) It is fairer to not count the dancer's worst scores so that dancers who just get one or two low scores are not disadvantaged.

(c) Alex 78
 Emma 34
 Mia 34
 Tom 75
 Yuki 51

First is Alex, second is Tom and third is Yuki.

Commentary on the answer

- (a) The method is brief, but it does give a set of rules and explains how to decide on the place order. However, It does not deal with what to do if there is a tie.
- (b) There is an explanation of why it is fairer to discount the lower scores.
- (c) The combined totals and place order have been worked out correctly.

Summary of updates

Version (Date of issue)	Section	Change
Version 1.0 (03/2023)		
Version 2.0 (11/2025)		Our Sample Assessment Materials have been updated as part of our accessibility principles and to reflect our live assessment materials. These resources are based on the Sample Assessment Materials, so some questions have been restructured or re-worded and the candidate style responses have been revised accordingly.

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